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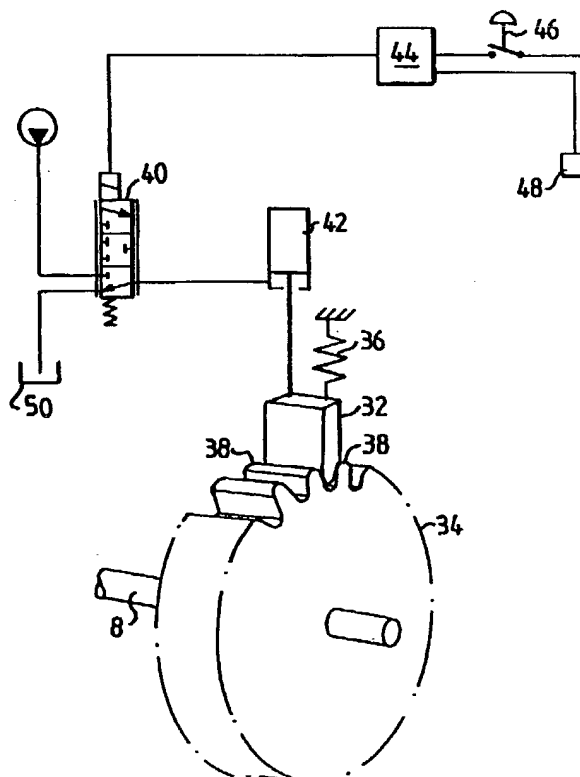
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(21) International Application Number: PCT/SE99/00797 (22) International Filing Date: 11 May 1999 (11.05.99) (30) Priority Data: 9801672-8 13 May 1998 (13.05.98) SE (71) Applicant (for all designated States except US): VOLVO WHEEL LOADERS AB [SE/SE]; S-631 85 Eskilstuna (SE). (72) Inventors; and (75) Inventors/Applicants (for US only): CARLSSON, Sven-Åke [SE/SE]; Klaraborgsvägen 7, S-632 39 Eskilstuna (SE). KARLSSON, Bo [SE/SE]; Ostra Knall, PL 1353E, S-635 08 Eskilstuna (SE). (74) Agents: BERG, S., A. et al.; Albihns Patentbyrå Stockholm AB, P.O. Box 5581, S-114 85 Stockholm (SE).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report. In English translation (filed in Swedish).	

(54) Title: BRAKING ARRANGEMENT AND BRAKING MANOUVRE MEANS

(57) Abstract

The invention relates to a brake assembly for a machine, comprising a locking element arranged to interact with an axle exiting from a gear box. The gear box comprises at least two gears.



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Braking arrangement and braking manouvre means

The present invention relates to a brake arrangement according to the precharacterizing clause of Patent Claim 1, and also a brake-operating assembly according to the precharacterizing clause of Patent Claim 5.

Brake arrangements of machines, such a wheeled loaders, dumpers and the like, are used to brake the movement of the machine and to prevent the machine from moving from a standstill. Such a brake arrangement is generally referred to as a parking brake. Some machines, such as wheeled loaders and dumpers, are provided with two brake pedals which are positioned in such a manner in a driver's cab of the machine that the driver can use either the right foot or the left foot to brake the machine.

It is previously known to arrange a brake arrangement in the form of a multiplate clutch on the output transmission shaft of a wheeled loader. The multiplate clutch functions as a parking brake and comprises a number of plates surrounded by a fluid present in the multiplate brake. When the parking brake is activated, the plates bear against discs in the multiplate brake so that the plates and thus the output transmission shaft are secured by means of friction. When the parking brake is deactivated, the plates are not in contact with the discs in the multiplate brake but rotate freely in the surrounding fluid. It has been found, however, that the viscous losses in the known brake arrangement are considerable when the parking brake is deactivated and the vehicle is driven forwards, which losses lead to increased fuel consumption of the machine. The viscous losses occur when the plates rotate in the surrounding fluid.

It is also previously known to arrange a mechanical connection in the form of a connecting shaft between

two brake pedals of a wheeled loader. The first brake pedal is connected to a valve which is arranged so as to control the flow of hydraulic fluid from a pressure source to brake cylinders of the machine. When the
5 second brake pedal is pressed down, the valve connected to the first pedal will be acted on by virtue of the fact that the connecting shaft between the brake pedals ensures that the first brake pedal is pressed down. The disadvantage of this known brake-operating assembly is
10 that the connecting rod occupies space on the floor of the driver's cab.

One object of the present invention is to produce a brake arrangement which is essentially loss-free when
15 the brake arrangement is activated.

This is achieved by means of a brake arrangement of the type indicated in the introduction, which has the features according to the characterizing part of Claim
20 1.

Such a brake arrangement results in imperceptible losses because the locking element engages with the output shaft only when the machine is at a standstill
25 and there is no contact between these components when the output shaft is rotating. The result of this is that the locking element does not cause any power losses during operation of the machine. By simultaneously engaging the gear clutches for the
30 respective gear steps, braking of the vehicle can be brought about by means of the brake arrangement. The brake arrangement can thus be used as a parking brake which is activated when the machine is driving along or at a standstill.

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Another object of the present invention is to produce a brake-operating assembly which eliminates a mechanical connection between two brake pedals and thus affords free floor space in a driver's cab.

This is achieved by means of a brake-operating assembly of the type indicated in the introduction, which has the features according to the characterizing part of Claim 5.

Such a brake-operating assembly allows a free floor space between the brake pedals, which increases the mobility of the driver and thus affords the driver greater comfort. The brake-operating assembly according to the invention also affords a simpler construction and thus easier mounting in the machine. The brake-operating assembly also leads to greater safety because a valve element is arranged at each brake pedal.

The invention will be described in greater detail below with the aid of exemplary embodiments shown in the appended figures, in which

Fig. 1 shows a diagrammatic, partly sectioned view of the transmission of a machine with a brake arrangement according to the present invention,

Fig. 2 shows a diagrammatic perspective view of a locking element according to the present invention, and

Fig. 3 shows a brake-operating assembly according to the present invention.

Fig. 1 shows an exemplary embodiment of a brake arrangement 1 according to the present invention. The brake arrangement 1 is arranged in the gearbox 2 of a machine 4, such as a wheeled loader, dumper or similar contractor's machine. The gearbox 2 is known per se and is of what is known as the power shift type which, in the exemplary embodiment shown, comprises an input shaft 6 from an engine (not shown) and an output shaft 8 which is connected to the drive shafts 10 of the machine. A torque converter 12 is arranged on the input shaft 6. Arranged in the gearbox 2 are a first, a second and a third shaft 14, 16 and 18 respectively

which each bear a number of gearwheels 20-25 which are mounted on the respective shaft 14, 16 and 18. The output shaft 8 is connected to the third shaft 18. To connect the gearwheels 20-25 to the shafts 14, 16 and 18, a gear clutch 26-30 is provided for each gearwheel 20-25. The gearbox 2 shown has four gear steps which are indicated by the numbers 1-4 within circles in Fig. 1. The gearwheels 26 and 27 are intended for forward and reverse gear, which gears are indicated by the letters F and B in Fig. 1. To change the gear in the gearbox 2, one of the gearwheels 20-25 is engaged by means of its associated gear clutch 26-30 at the same time as another gearwheel is disengaged by means of its associated gear clutch. How the changing takes place in a power shift gearbox is known to the expert in the field, for which reason it is not described in greater detail here.

The brake arrangement 1 comprises a locking element 32 which is adapted to engage with a gearwheel 34 arranged on the output shaft 8. Fig. 2 shows diagrammatically how such a locking element 32 can be designed. In the figure, the locking element 32 has taken up a locked position, a pressure spring 36 having inserted the locking element 32 between two teeth 38 on the gearwheel 34. In this locked position, the output shaft 8 from the gearbox 2 is prevented from rotating, which means that the machine 4 cannot move. The locking element 32 functions as a parking brake and is intended to engage in the gearwheel 34 when the machine 4 has stopped and is at a standstill. The parking brake can, however, be activated while the machine is moving. To free the locking element 32 and thus release the parking brake, an actuator valve 40 is activated, which allows hydraulic fluid to pass to a cylinder 42 which brings the locking element 32 out of engagement with the gearwheel 34.

A control unit 44 connected to the actuator valve 40 receives signals on the one hand from a parking brake-operating means 46, such as a push-button or a lever, and on the other hand from a sensor 48 which measures the speed of the machine 4. The locking element 32 can be activated by the parking brake-operating means 46 when the machine 4 is driving along. When the machine 4 has subsequently stopped and the sensor 48 sends signals to the control unit 44 that the speed is zero, the cylinder 42 in Fig. 2 will be emptied by the valve 40 being set to the position shown in Fig. 2. The pressure spring 36 then inserts the locking element 32 between the teeth 38 of the gearwheel 34, so that the locking element bears against the flanks of the teeth 38.

In the event that the brake arrangement 1 is activated using the parking brake-operating means 46 when the machine 4 is driving along, as described above, the speed of the machine 4 must thus be braked down to zero in order for the locking element 32 to be capable of engaging in the gearwheel 34. This braking is brought about by the control unit 44 sending signals to two different gear clutches 26-31 in the gearbox 2, so that the output shaft 8 from the gearbox 2 is braked. The gear clutches 26-31 consist of multiplate clutches, which means that the braking of the output shaft 8 takes place proportionally to the pressure applied to the plates. The control unit is thus connected to the gear clutches 26-31, as shown in Fig. 1. Only two gear clutches 26-31 are connected to the control unit 44 in Fig. 1, but it is of course possible for all the gear clutches 26-31 to be connected to the control unit 44. If the parking brake-operating means 46 is activated when the machine 4 is driving along, the control unit 44 will thus receive information that the machine 4 is driving along. The control unit 44 then activates two gear clutches 26-31 in the gearbox 2, for example the gear clutches 28, 29 for first and second gear, after

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which the machine 4 will be braked. The control unit 44 subsequently receives information that the machine 4 is at a standstill, after which the locking element 32 can be activated by the control unit 44.

5

The actuator valve 40 is electrically controlled and spring-loaded, so that the actuator valve 40 takes up the position shown in Fig. 2 when the power supply to the actuator valve 40 ceases. In this position, the cylinder 42 is drained of hydraulic fluid to a tank 50. As the pressure spring 36 acts with a pressing force on the locking element 32, the pressure spring 36 will guide the locking element 32 in the direction towards the gearwheel 34 when the cylinder 42 is drained. The locking element 32 will thus engage in the gearwheel 34 when the power supply to the actuator valve 40 ceases. The locking element 32 is designed in such a manner that it will bounce on the teeth 38 if the force acting against the spring 36 disappears when the output shaft 8 is rotating, which can occur if no power is being supplied to the actuator valve 40.

The functioning of the actuator valve 40 means that the locking element 32 always engages in the output shaft 8 when the machine 4 is at a standstill and the engine is switched off, irrespective of whether the parking brake-operating means 46 is activated or not.

If a neutral gear position is selected, that is to say no gear in the gearbox 2 is engaged or activated, and the parking brake-operating means 46 is not activated, the control unit 44 will send signals to the gear clutches 26-31 when the machine has stopped, so that the gearwheels 20-25 of which the gear clutches 26-31 are applied brake and secure the machine 4.

When the engine of the machine 4 is started, two gear clutches 26-31 will always be activated in order to secure the machine 4 irrespective of the position of a

gear lever (not shown) for the gearbox 2. In order to activate the gear clutches 26-31 and also the locking element 32, so as thus to allow the machine 4 to be capable of driving along, the gear lever must be shifted into a neutral position.

In order to tow the machine 4, the locking element 32 and the gear clutches 26-31 must be released. If the engine is switched on, there is a bridging function in the electrical system of the machine 4, which provides a completely disengaged transmission. In the event of power loss or when the engine is switched off, it is possible to release the locking element 32 mechanically by means of an adjusting screw on the outside of the gearbox 2.

Above, a locking element 32 has been described, which engages in a gearwheel 34 arranged on the output shaft 8. However, it is also possible to provide a locking element 32 which engages directly with the output shaft 8, such as a dry friction multiplate clutch or a jaw clutch (not shown).

Fig. 3 shows a brake-operating assembly 52 for a machine 4, such as a wheeled loader, dumper or similar contractor's machine. The brake-operating assembly 52 comprises a first and a second brake pedal 54 and, respectively, 56. A first valve element 58 is connected to the first brake pedal 54 and a second valve element 60 is connected to the second brake pedal 56. The first and second valve elements 58 and 60 are arranged so as to control the flow of hydraulic fluid from a pressure source 62 to brake cylinders 64 and 66, which are arranged at the wheels 68 of the machine 4, in order to brake the machine 4. Arranged between the first and the second brake pedal 54 and 56 is a connection which consists of a connecting line 70 for hydraulic fluid arranged between the first and the second valve element.

A shuttle valve 72 is arranged in the connecting line 70, which shuttle valve 72 closes the connection between the second valve element 60 and the brake cylinders 64 when the first valve element 58 is activated by the first brake pedal 54. When the second valve element 60 is activated by the second brake pedal 56, the shuttle valve 72 closes the connection between the first valve element 58 and the brake cylinders 64.

10

According to the exemplary embodiment shown in Fig. 3, the shuttle valve 72 is arranged in a first brake line 74 which is connected to the brake cylinders 64 which are located on a first wheel axle 76 of the machine 4.

15 The first wheel axle 76 may be a rear axle of the machine 4.

The first valve element 58 comprises a first and a second slide valve 78 and, respectively, 80 which are arranged in such a manner that the first slide valve 78 controls the second slide valve 80 when the first slide valve 78 is activated by the first brake pedal 54. As shown in Fig. 3, this control can be mechanical.

20 The first slide valve 78 is connected to the shuttle valve 72 and the second slide valve 80 is connected via a brake line 82 to the brake cylinders 66 which are located on a second wheel axle 84 of the machine 4. The second wheel axle 84 may be a front axle of the machine 4.

25 30 4.

A pilot line 86 for hydraulic fluid is arranged between the first and the second valve element 58 and 60, so that, when the second valve element 60 is activated by the second brake pedal 56, the first valve element 60 will be activated by the hydraulic fluid in the pilot line 86.

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The brake pedals 54 and 56 are preferably positioned next to one another on the floor in a driver's cab (not shown) of the machine 4. The connecting line 70, the shuttle valve 72 and the pilot line 86 are then positioned under the floor, so that a free space is formed on the floor between the brake pedals 54 and 56. The brake-operating assembly 52 according to the invention is redundant, that is to say if one valve element 58 or 60 breaks down, the machine 4 can still be braked by the second valve element 58 or 60. If the pressure source 62 should break down, accumulators 88 are provided, which contain hydraulic fluid under pressure. By means of the accumulators 88, the machine 4 can be braked in spite of the fact that the pressure source is non-functional.

Patent Claims

1. Brake arrangement for a machine (4), comprising
a locking element (32) which is adapted to engage with
5 an output shaft (8) from a gearbox (2), which gearbox
(2) comprises at least two gearwheels (20-25) in order
to obtain different gears and a gear clutch (26-31)
provided for each gearwheel (20-25) and adapted to
engage and disengage the respective gearwheel (20-25)
10 depending on the operating conditions of the machine
(4), characterized in that a control unit (44) is
arranged so as to control the gear clutches (26-31) so
that they simultaneously engage at least two of the
gearwheels (20-25) so as thus to brake the output shaft
15 (8), and in that the control unit (44) is arranged so
as to control the locking element (32) so that the
locking element (32) engages with the output shaft (8)
when the output shaft (8) is at a standstill, the
result of which is that the output shaft (8) is
20 prevented from rotating when the locking element (32)
engages with the output shaft (8).
2. Brake arrangement according to Claim 1,
characterized in that the locking element (32) is
25 spring-loaded by means of a spring (36) so as to engage
with the output shaft (8), and in that a means (42) is
adapted to counteract the spring (36) so as to bring
the locking element (32) out of engagement with the
output shaft (8).
- 30 3. Brake arrangement according to Claim 2,
characterized in that said means is a cylinder (42)
which is controlled by an actuator valve (40).
- 35 4. Brake arrangement according to any one of the
preceding claims, characterized in that the locking
element (32) is adapted to engage positively between at
least two teeth (38) of a gearwheel (34) arranged on
the output shaft (8).

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5. Brake-operating assembly for a machine (4), comprising a first and a second brake pedal (54, 56) which are interconnected with one another, and a first valve element (58) which is connected to the first
5 brake pedal (54) and is arranged so as to control the flow of hydraulic fluid from a pressure source (62) to brake cylinders (64, 66) of the machine (4), characterized in that a second valve element (60) is
10 connected to the second brake pedal (56) and is arranged so as to control the flow of hydraulic fluid from the pressure source (62) to the brake cylinders (64, 66) of the machine (4), and in that the connection
15 between the first and the second brake pedal (54, 56) consists of at least one connecting line (70) for hydraulic fluid arranged between the first and the second valve element (58, 60).

6. Brake-operating assembly according to Claim 5, characterized in that a shuttle valve (72) is arranged
20 in the connecting line (70), which shuttle valve (72) closes the connection between the second valve element (60) and the brake cylinders (64) when the first valve element (58) is activated by the first brake pedal (58), and vice versa.

25 7. Brake-operating assembly according to Claim 5 or 6, characterized in that the shuttle valve (72) is arranged in a first brake line (74) which is connected to the brake cylinders (64) which are located on a
30 first wheel axle (76) of the machine (4).

8. Brake-operating assembly according to any one of Claims 5-7, characterized in that the first valve
35 element (58) comprises a first and a second slide valve (78, 80) which are arranged in such a manner that the first slide valve (78) controls the second slide valve (80) when the first slide valve (78) is activated by the first brake pedal (54).

9. Brake-operating assembly according to Claim 8, characterized in that the first slide valve (78) is connected to the shuttle valve (72), and in that the second slide valve (80) is connected via a second brake line (82) to the brake cylinders (66) which are located on a second wheel axle (84) of the machine (4).

10. Brake-operating assembly according to any one of Claims 5-9, characterized in that a pilot line (86) for hydraulic fluid is arranged between the first and the second valve element (58, 60), so that, when the second valve element (60) is activated by the second brake pedal (56), the first valve element (58) will be activated by the hydraulic fluid in the pilot line (86).

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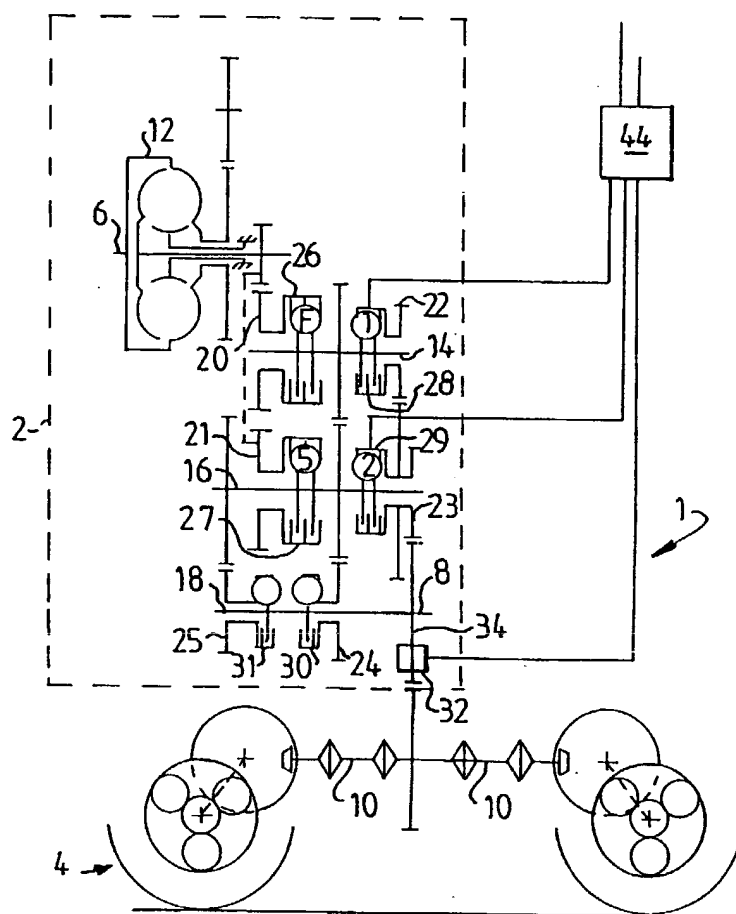


FIG. 1

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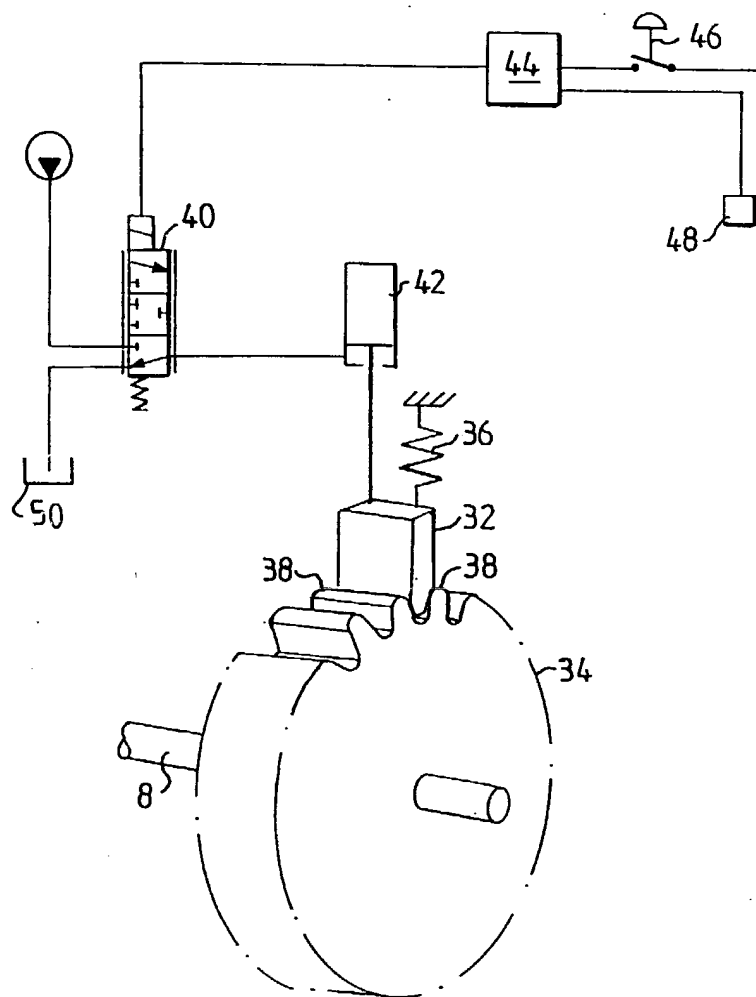
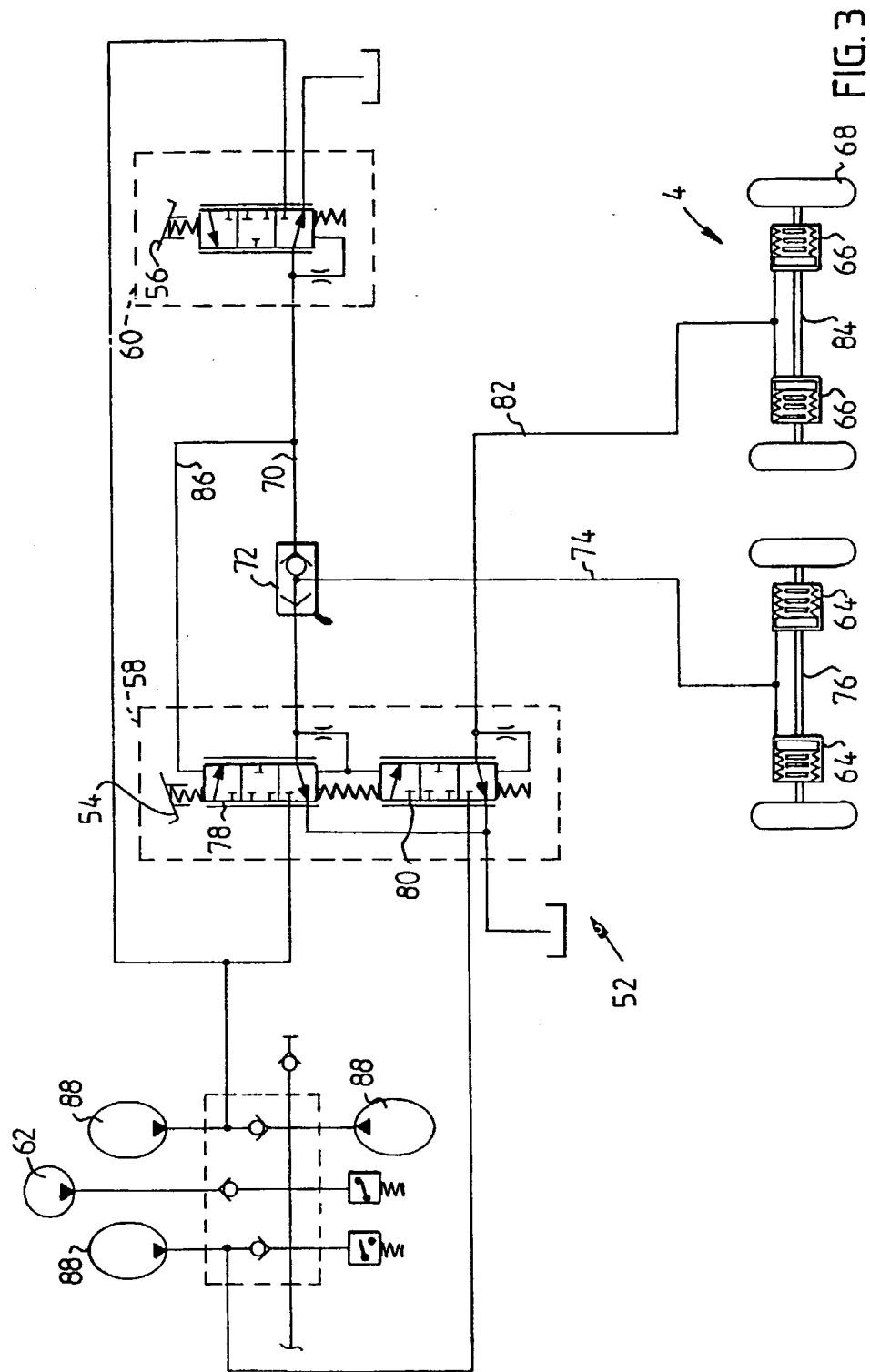


FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00797

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60T 1/06, B60T 13/22, F16D 59/02, F16D 63/00 // F16H 057/10, F16H 057/12
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B. FIELDS SEARCHED

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0841126 A2 (HILTI AKTIENGESELLSCHAFT), 13 May 1998 (13.05.98), figure 3, claims 1-3,5,6 --	1,2
A	EP 0891902 A1 (AISIN AW CO.; LTD ET AL), 20 January 1999 (20.01.99), figure 1, claims 1-10 --	1
A	WO 9309981 A1 (KIM), 27 May 1993 (27.05.93), figures 1,2, claim 1 -- -----	1,2

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Patent document cited in search report			Publication date	Patent family member(s)		Publication date
EP	0841126	A2	13/05/98	DE	19646382 A	14/05/98
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				US	5879111 A	09/03/99
<hr/>						
EP	0891902	A1	20/01/99	WO	9725231 A	17/07/97
<hr/>						
WO	9309981	A1	27/05/93	AU	2913492 A	15/06/93
				KR	9504318 B	28/04/95
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